MIDAS Mechanical Design

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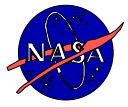
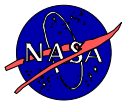
Agenda

- Experiment Overview
- Procured Components
- Designed Components



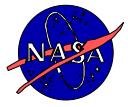
Experiment Overview

- General Experiment Description
  - Data Electronics
  - Vacuum Chamber
  - Cryogenic Cooler
  - Fan
  - Ion Pump
  - Battery
- General Experiment Operations
  - Launch
  - Orbiter Operations
  - Orbiter to Mir Transfer
  - Mir Operations



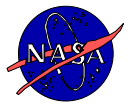
Procured Components

- Cryogenic Cooler
- Ion Pump
- Fan
- Battery

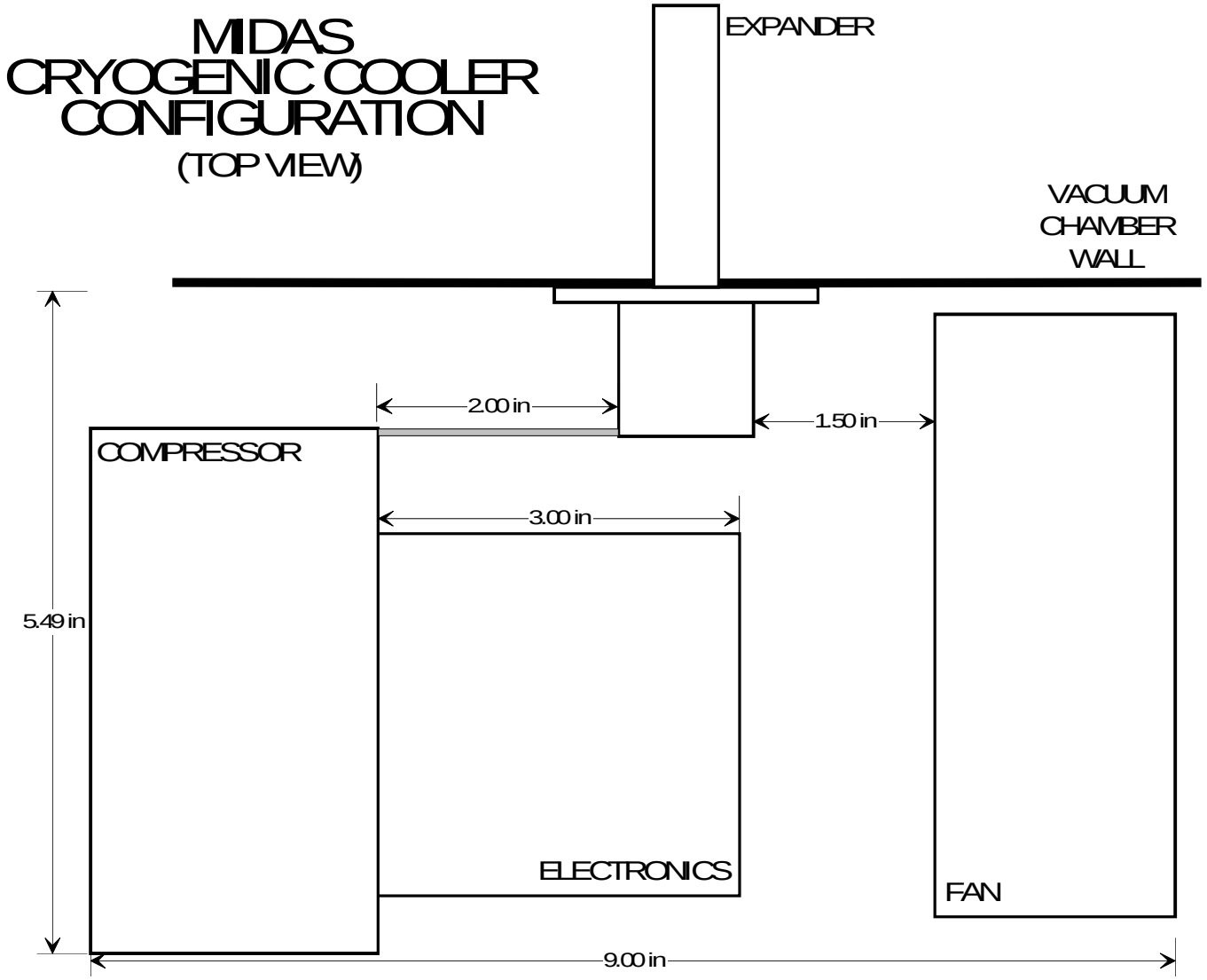


Cryogenic Cooler

- Vendor: Texas Instruments
- Status: On hand
- Capacity: 1 watt to 80 K at 20°C
- Input Power: 60 w max., 35 w typ.
- Input Voltage: 17 to 32 VDC
- Operating Temperature: -54°C to 71°C
- Acoustic Noise: less than 60 db at 1 meter
- Weight: 4.1 lb.
- Dimensions: compressor 4.5”x 2.4”, expander 2.2”x 3.5” , electronics 4”x 3”x 1”

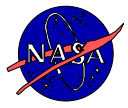


Cryogenic Cooler



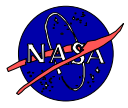
Ion Pump

- Vendor: Kernco Inc.
- Status: Expected delivery 12/15/95
- Pumping Speed: 0.5 l/s at 10^{-5} to 10^{-8} torr
- Input Power: 2 w max.
- Input Voltage: 10 to 14 VDC
- Operating Temperature: 0°C to 45°C
- Weight: 2 lb
- Dimensions: 2.1”x 5.4”



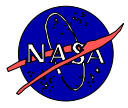
Fan

- Vendor: Comair / Rotron
- Status: On hand
- Capacity: 85 CFM
- Input Power: 3.4 w max.
- Input Voltage: 24 to 56 VDC
- Operating Temperature: -10°C to 70°C
- Weight: 1.4 lb.
- Dimensions: 4.7”x 4.7”x 1.5”



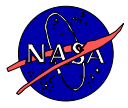
Battery

- Vendor: Progressive Technologies, Inc.
- Status: Expected delivery 11/27/95
- Capacity: 17,000 mah, 20 hours @ load
- Margin: 75 %
- Operating Temperature: -20°C to 54°C
- Configuration: 8 D-cells, 2 x 4
- Weight: 2.4 lb.
- Dimensions: 2.5”x 5.1” x 2.4”
- Shuttle approved



Designed Components

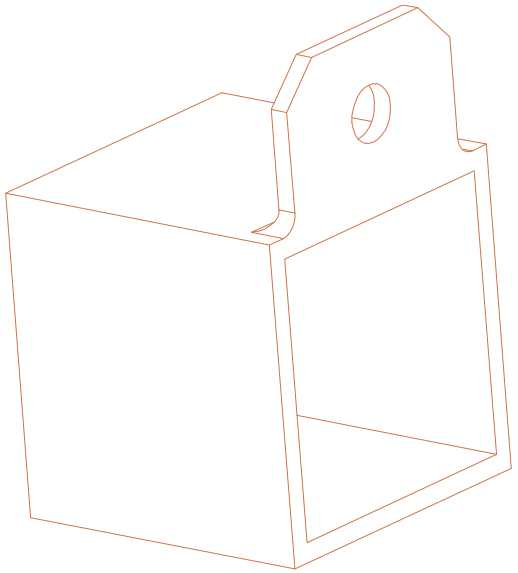
- Support Cube
- Support Cone
- Battery Box
- Cryogenic Cooler Brackets
- Vacuum Chamber
- Electronics Housing
- Experiment Housing



Support Cube

Design Requirements

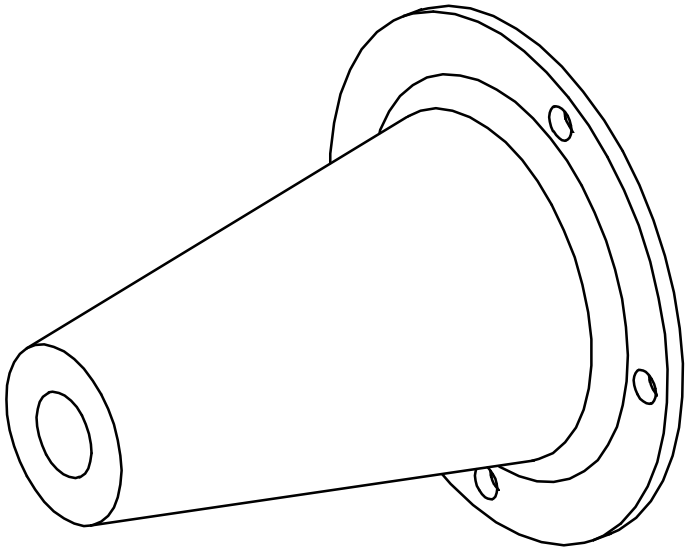
- Good thermal conductor - isothermal
- Support HTS materials at cryogenic temperatures
- Maintain bonding to substrates at cryogenic temperatures
- 4 sq. in. surface area
- Minimize weight
- Provide attachment points for support cone, wires, and thermal strap



Support Cone

Design Requirements

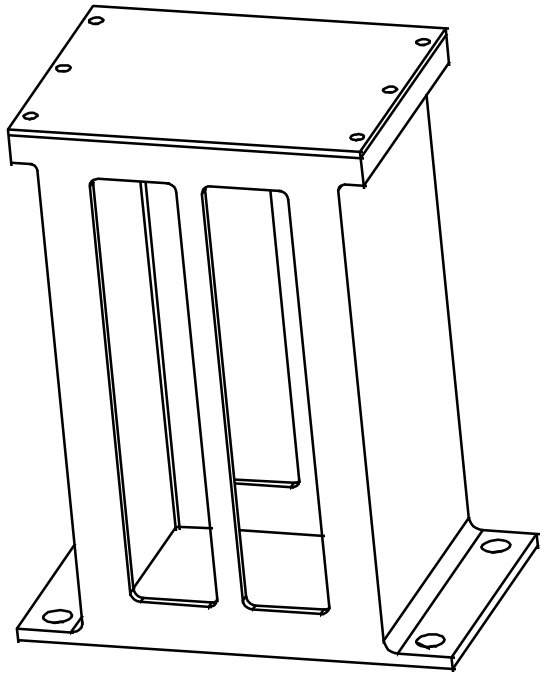
- Support mass of copper cube and a fastener at one end under launch loads
- Mount to the vacuum chamber
- Poor thermal conductor
- Manufacturable to .020” wall thickness
- Shape optimized to minimize stresses and thermal conductance
- Minimize outgassing
- Withstand thermal gradient from 300K to 70K over its length
- Height suitable for thermal strap
- Adequate thickness at tip for an insert



Battery Box

Design Requirements

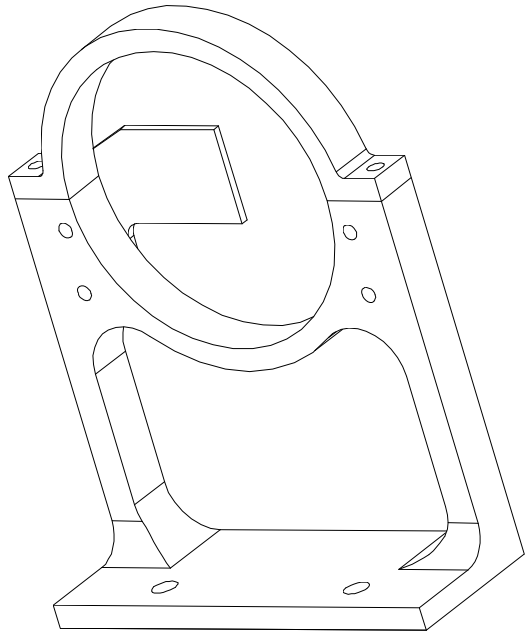
- Lightweight, structurally sound material
- Hold a 2.4 lb, 2.5”x5.1”x2.4” battery pack consisting of 8 D-cell alkaline manganese batteries in a 2x4 configuration
- Provide a vent path
- Minimize area required on experiment mounting plate



Cryogenic Cryocooler Brackets

Design Requirements

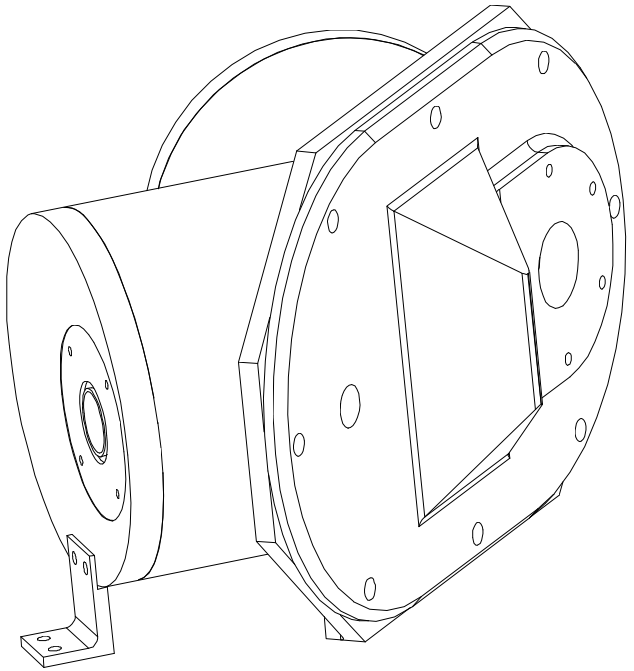
- Lightweight, structurally sound
- Thermally conductive
- Constrain the cryocooler to withstand launch/landing loads



Vacuum Chamber

Design Requirements

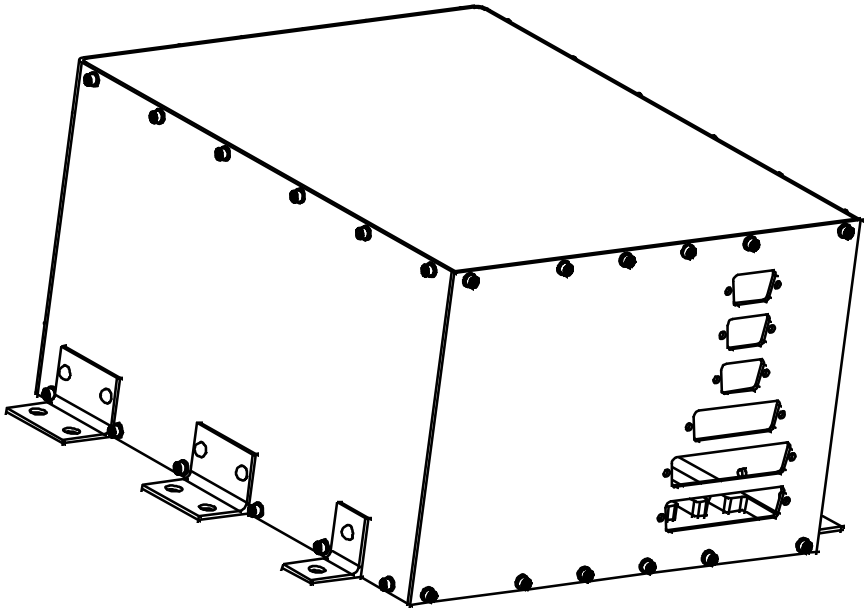
- Stainless Steel to facilitate bakeout
- Weight less than 11 lb.
- Maintain a minimum vacuum of 10^{-5} torr
- Provide support for the sample cone / cube, cryocooler expander, and ion pump
- Provide an attachment point for two hermetic connectors
- Easy accessibility to connectors, HTS samples, and cryocooler expander
- Pinch off tube for pump down access
- Mounted to withstand launch / landing loads
- Maintain structural integrity under maximum Priroda pressure loads



Electronics Housing

Design Requirements

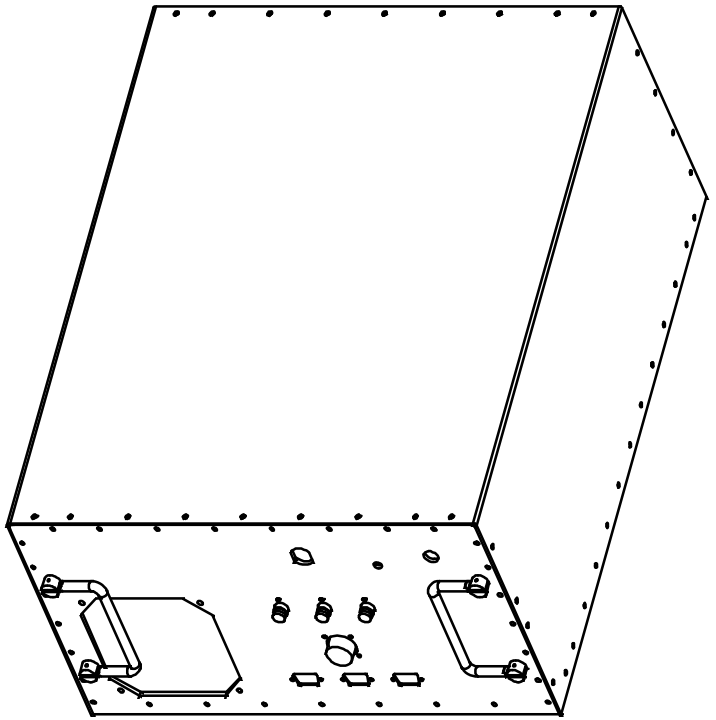
- Lightweight, structurally sound
- Contain electronic cards used on MIDAS in an existing card cage
- Electrically conductive
- Minimize surface area on base plate
- Minimize EMI
- Able to withstand launch/landing loads



Experiment Housing

Design Requirements

- Interface with Shuttle middeck locker and Priroda single stowage locker
- Mechanism to transport experiment to/from Priroda
- Able to withstand Shuttle launch/landing loads
- Provide for power and GSE data connections
- Fire hole per IDD-MDK
- Labeling, switches/circuit breakers per US/R 002, IDD-MDK
- Foam per US/R 002, IDD-MDK
- Provide for inlet and outlet areas for fan
- Provide an EMI-shielded enclosure



Weight Margins

	Experiment	Limit	Margin
PDR	47.1 lb.	54 lb.	13%
CDR	47.8 lb.	54 lb.	12%